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Panel Studies of New Venture Creation:

A Review and Suggestions for Future Research

Abstract

We review all journal articles based on "PSED-type" research, i.e., longitudinal, empirical studies of large probability samples of on-going, business start-up efforts. We conclude that the research stream has yielded interesting findings; sometimes by confirming prior research with a less bias-prone methodology and at other times by challenging whether prior conclusions are valid for the early stages of venture development. Most importantly, the research has addressed new, process-related research questions that prior research has shunned or been unable to study in a rigorous manner. The research has revealed an enormous and fascinating variability in new venture creation that also makes it challenging to arrive at broadly valid generalizations. An analysis of the findings across studies as well as an examination of those studies that have been relatively more successful at explaining outcomes give good guidance regarding what is required in order to achieve strong and credible results. We compile and present such advice to users of existing data sets and designers of new projects in the following areas: *Statistically representative and/or theoretically relevant sampling; Level of analysis issues; Dealing with process heterogeneity; Dealing with other heterogeneity issues,* and *Choice and interpretation of dependent variables.*

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Introduction

The creation of new firms is a phenomenon great importance for employment creation, productivity growth and innovations (van Praag & Versloot, 2007). Yet, due to its emergent, elusive and nebulous nature and the fact that firms not yet in existence do not appear in any sampling frames, researchers have either shunned studying the process by which new ventures come into existence or they have been confined to exploring it via survivor-biased samples and retrospective case studies. This is why the occurrence of a longitudinal approach to the systematic, large-scale study of on-going new venture start-up processes 'as they happen' is potentially an important breakthrough. The *Panel Study of Entrepreneurial Dynamics* (PSED) (Gartner et al., 2004b; Reynolds, 2007) was the first full scale realization of such a project. The PSED has established a new empirical approach that – with local variations – has been employed by several large scale studies that have been completed, are on-going, or under way in a range of countries (Reynolds & Curtin, forthcoming).

The basic design of this type of research – below referred to as 'PSED-type research' – can be summarized as follows (Reynolds, 2009): a probability sample of 'nascent entrepreneurs' (NEs) is obtained through phone interviews with a very large number of adult members of households, selected through random digit dialing. Answers to a screening questionnaire determine whether respondents are involved in on-going but not yet operational business start-ups in which they are going to be (part) owners. Qualified NEs are directed to a comprehensive interview. Eligible cases are later re-interviewed every 6-12 months over 2 to 5 years in order to

follow the process and assess outcomes. The early stage random sampling serves to ascertain representativeness. In particular it reduces the survivor bias that occurs when only cases that led to up and running businesses are included. The longitudinal design permits studying process issues. Further, the real time assessment of the development of the start-up process reduces issues of memory decay and hindsight bias. The research has demonstrated that it is practically possible to identify emerging ventures at an early stage and to get an impressively large proportion of identified NEs to complete very comprehensive surveys and continue to cooperate in subsequent waves (Gartner et al., 2004b; Samuelsson & Davidsson, 2009).

The purpose of this paper is to take stock of the contributions of this research stream in order to assist users of current data sets as well as designers of new projects in making full use of this research approach. Importantly, we are undertaking a different type of review than the regular assessment of findings across studies regarding a particular research question, or the compilation of evidence for or against particular theories. Instead we are reviewing the contributions and issues associated with a particular approach to studying a phenomenon, namely PSED's real time, longitudinal approach to researching the creation of new firms. We will make generalizations of findings across studies where possible, but this will constitute a minor focus of our review. Methodological problems and solutions that are revealed either through patterns across studies or through particularly important exemplar studies will be a more central theme.

Focus and development of the research stream

We focus on all peer reviewed, published or accepted/in press journal articles, which are based on PSED-type data sets. Through a comprehensive search we were able to locate 75 such articles, including a few articles from 1992-7 that are direct 'ancestors' to PSED and which partly used the same methodology. The 75 articles are based on data sets from Canada,

Netherlands, Norway, Sweden and the US. While we focus our review on peer reviewed journal articles we recognize that the research stream has also yielded a significant number of other types of publications (see, e.g., Frid et al., 2009). We will make occasional references to these other works on technical or purely descriptive matters or as supplementary evidence from projects where the findings have not yet reached journal publication.

FIGURE 1

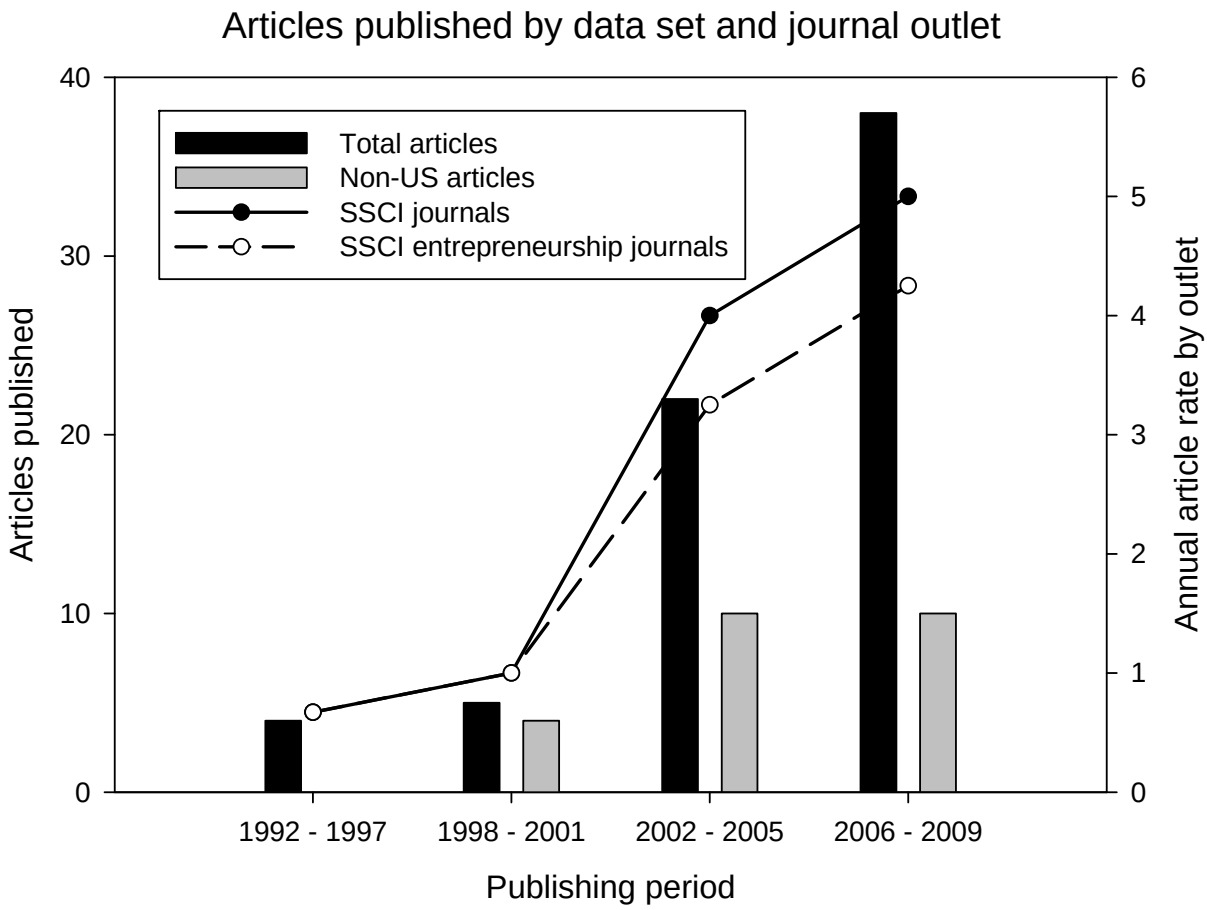
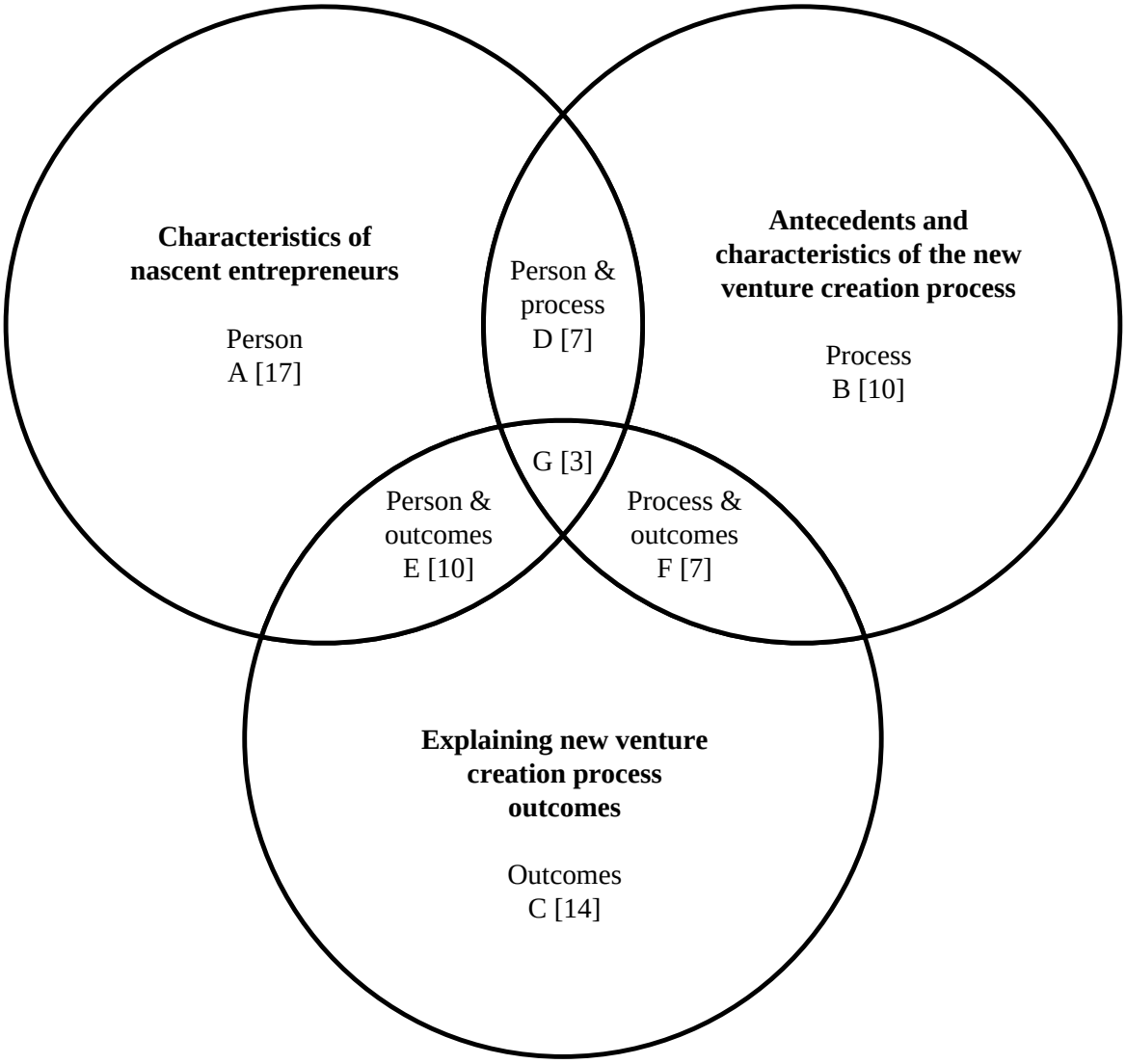


Figure 1 gives a first overview of how this research stream has evolved over time. The data reveal that it started as a small conversation in leading entrepreneurship journals. While the proportion of SSCI-listed journals has remained high the types of outlet has broadened from 2002-5 and now includes articles in mainstream management and disciplinary journals of very high standing such as *Accounting Review; American Sociological Review; Management Science; Journal of Management; Journal of Management Studies* and *Strategic Management Journal.* The 'pilot project' period 1992-7 was solely US-based. Somewhat peculiarly, the 1998-2001 period representing the early output from the first generation national projects, was dominated by non-US (i.e., Norwegian and Swedish) articles, whereas the strong growth in recent years is based on US data. An explanation for this pattern is that the original PSED was a complex effort involving many teams and researchers, where the data sets were eventually put in the public domain (http://www.psed.isr.umich.edu/psed/home). By contrast, the international sister studies were less comprehensive efforts run by small teams and where the data remained proprietary. This may have led to quicker first publications but lower total output from the latter projects. The marked increase over time, with close to 40 out of the 75 articles published in the most recent period, is the perhaps most obvious observation in Figure 1. This growth is likely to continue and become more internationally balanced as the 'second generation' projects are starting to yield journal output (Reynolds & Curtin, forthcoming).

Figure 2 shows that three partly overlapping areas capture most of the research, namely *Characteristics of Nascent Entrepreneurs [A]; Antecedents and Characteristics of the New Venture Creation Process [B]*, and *Explaining New Venture Creation Process Outcomes [C]*. The numbers indicate that these areas have attracted roughly equal attention. Seven articles that are macro-, methods-, or overview-orientated were excluded from Figure 2.

FIGURE 2

Topical focus of the reviewed articles



A first main observation from this figure is that the research approach has added to the entrepreneurship literature a significant number of articles representing systematic, large-scale study of new venture creation process issues. The prior literature focusing on the process itself was very limited and usually cases-based (Bhave, 1994; Van de Ven et al., 1999). A second main observation is the presence of a large number of articles examining ‘characteristics of

entrepreneurs' combined with the absence of articles focusing on 'characteristics of opportunities' or the 'individual-opportunity nexus'. This shows that the research stream has not fully responded to Shane and Venkataraman's (2000) criticism that much entrepreneurship research is one-legged in its focus on individuals at the neglect of the opportunities (or 'venture ideas'). Articles focusing on the opportunity or the individual-opportunity nexus are not completely lacking (e.g. Gartner, Shaver, & Liao, forthcoming; Smith, Matthews, & Schenkel, 2009). However, even with a very generous re-classification they would be much fewer than those concentrating on each of the three themes in Figure 2.

We have also tried to classify the 75 articles according to their principal level of analysis. It turns out that while the very first article in the series (Reynolds & Miller, 1992) had a venture level focus the individual level is the most frequently applied with 42 articles using it. The emerging venture is the main focus in 25 of the articles while much lower numbers – three each – use the team or the nation as the principal level of analysis. The remaining two articles are overviews that do not focus on a particular level. While the related *Global Entrepreneurship Monitor* research (Reynolds et al., 2005) may be better suited for many nation level research questions the low numbers in this category may indicate an opportunity for future research using PSED-type data. This applies even more to the team level, especially as the publicly available 'PSED II' data set has very rich data on team members (see www.psed.isr.umich.edu/psed/documentation).

The frequent use of the individual level is consistent with the sampling mechanism, which aims at a representative sample of nascent entrepreneurs, i.e., *individuals* who are currently involved in an on-going business start-up effort. However, the very notion of NE

indicates a certain mix-up of levels as it is really the *venture* that is nascent; the founders may have experience from previous as well as concurrent ventures (cf. Alsos & Kolvereid, 1998).

We will structure the next part of our review according to these three topics, devoting relatively more space to research explaining venture creation outcomes. In the latter part of the review we will discuss opportunities for further progress in research using the PSED approach.

Findings regarding characteristics of nascent entrepreneurs

Of the articles that have focused on characteristics of nascent entrepreneurs, 14 make comparisons between NEs and a control group representing the general population, while 20 make comparisons between subgroups of NEs by gender, ethnicity or type of venture (some make both within-NE and external comparisons) and 6 have other foci. The rich and varied topics that have been addressed can be broadly captured within three themes, namely *resource endowments; motivation and cognition*, and *entrepreneurial teams*.

As regards resource endowments the results largely confirm the picture derived from prior research using other methods approaches (see, e.g., Shane, 2003). Regarding *human capital* (HC) the studies consistently show NEs have higher *education* and more *previous start-up experience* than others (Davidsson & Honig, 2003; Delmar & Davidsson, 2000; Kim, Aldrich & Keister, 2006; Reynolds, 1997; Reynolds et al,, 2004; Rotefoss & Kolvereid, 2005). The influence of *social capital* has been less researched and the results are harder to summarize. A clear deviation from what prior research suggests (see Shane, 2003: 86-9) is that there is no positive effect whatsoever in the US PSED study of having self-employed parents on the probability of NE status (Kim et al., 2006; cf. Reynolds, 2007). This result may be due to the US in the late 1990s having become a society where entrepreneurship was so mainstream that

'having it in the family' was no longer particularly important. By contrast, Swedish results indicate positive role modeling effects (Davidsson & Honig, 2003; Delmar & Davidsson, 2000).

The main finding regarding *financial capital* is that household income and net worth typically do *not* discriminate between NEs and others (Kim et al., 2006; Reynolds, 1997; Reynolds et al., 2004). Further, most business founders invest very limited sums in their start-up attempts (Kim et al., 2006). Findings suggesting that financial resources have relatively little influence is commonplace in prior literature as well, which can be explained by an opportunity cost argument (cf. Shane, 2003, 63-4). However, articles included in our review suggest that the amount of money available certainly restricts *what kind* of start-up a given NE can pursue. Accordingly, Cassar (2006), Liao and Welsch (2003), and Singh, Knox and Crump (2008) all report that NEs with more financial capital have higher growth aspirations for their ventures.

While the findings regarding resource endowments largely confirm previous findings the PSED-type stream of research has yielded interesting, non-obvious and novel findings regarding business founders' motivations and expectations. For example, Carter et al. (2003) compared business founders' career reasons with those of others and found that NEs do not stand out as markedly different. They are not more financially motivated upon entry, nor more driven by a quest for innovation. Neither are there any significant differences for self-realization or independence. Further, NEs are less inclined than others to follow role expectations, and they also care less about external recognition. Similarly, Xu and Ruef's (2004) sophisticated analyses consistently show that nascent entrepreneurs are *more* risk-averse than the general population, and Schenkel, Matthews and Ford (2009) demonstrate that NEs score higher than the general population on 'Need for Closure', i.e., preferring order and predictability to continued ambiguity (unlike the still often cited findings of Scheré, 1982). These results give strong reasons to

question views of the entrepreneurs' motivations derived from armchair theorizing or atypical cases highlighted in the media. Alternatively, they give reason to reconsider what empirical phenomenon PSED-type research actually captures. We will return to this question when discussing advice for future research.

The small number of articles focusing on teams has yielded some important revelations. Apart from their ubiquity (with more than 50 percent of NEs working in team rather than pursuing solo efforts; see Davidsson & Honig, 2003; Kim et al., 2006) it is clear that a large proportion are spouse or *de facto* couples that are best analyzed separately from other teams in order not to completely blur important relationships (Ruef et al., 2003; Liao, Li & Gartner, forthcoming). Further, even among the remainder homophily rather than functional diversity drives team formation (Ruef et al., 2003). The research also reveals that teams are not necessarily stable and that their dynamics can be counter-intuitive (Chandler, Honig & Wiklund, 2005).

Overall, the reviewed research stream has confirmed certain effects and non-effects of resource endowments on the propensity to (try to) found a firm. In the area of motivation and cognition the PSED-type research has brought some novelty and surprise, and important conclusions can also be drawn from this research regarding the ubiquity and true nature of founding teams. Knowing about these empirical realities is essential for avoiding major theory-data mismatches in entrepreneurship research aiming to be valid for the entire population of start-ups and/or business founders.

Findings regarding antecedents and characteristics of the new venture creation process

In terms of Shane and Venkataraman's (2000) sub-division of the venture creation process into *discovery* and *exploitation*, 8 articles have addressed the former and 20 the latter. As regards discovery, a relatively non-systematic search for opportunity, and processes triggered by

a particular idea rather than by a wish to become a founder-manager seem to be relatively more common than systematic, textbook-like processes (Singh et al., 2008; Honig, 2001; cf. Gartner & Carter, 2003). In terms of prior literature this finding resonates with Bhave's (1994) 'internally stimulated' process and Sarasvathy's (2001) notion of 'effectuation'. Importantly, however, this descriptive result does not necessarily have any prescriptive implications. Even if less common those ventures resulting from systematic search may achieve better outcomes (Patel & Fiet, 2009, cf. Edelman, Manolova & Brush, 2008).

A series of questions about the occurrence and timing of a number of 'gestation activities' (saving money; talking to customers; acquiring resources; registering the business, etc.; see Gartner, Carter and Reynolds, 2004a) are the basis of most findings regarding the exploitation process. This is an area where this research stream has added genuinely new insights. However, the most striking findings are descriptive and concern the extreme variability and complexity of venture creation processes, with gestation duration variance ranging at least from 1 month to 10 years (Reynolds & Miller, 1992) and giving Liao, Welsh and Tan (2005) reason to conclude that firm gestation is "a complex process that includes more than simple, unitary progressive paths" (2005: 15) and "a process where developmental stages are hardly identifiable" (2005: 13).

However, relatively clear results have been reported regarding process differences by type of entrepreneur or type of venture. Samuelsson and Davidsson (2009) as well as Liao and Welsch (2008) demonstrated that the exploitation process is systematically different by level of innovativeness or technology base, while Alsos and Kolvereid (1998) found differences between novice and habitual entrepreneurs.

In all, the research has shown that the business creation process is more complex and variable than previously thought. While this insight is important for our understanding of the phenomenon and the design of future research, more work is needed before findings can be translated into credible prescriptions. The detection of systematic subgroup differences suggests it is possible to bring some order to (the understanding of) this complexity.

Findings regarding explanations of new venture creation process outcomes

An obvious first question regarding outcomes is: What proportion actually manages to create an up-and-running business? Across four studies Parker and Belghitar (2006) report 33-48 percent being operational within 12 months of the first interview. Basing the analysis on time since the conception date rather than time from the first interview, Reynolds (2007) reports that after seven *years* roughly one third each in the US PSED report operational status, termination, or being 'still trying'. As a rule of thumb it seems reasonable to conclude that somewhere between 1/3 and 1/2 of NEs reach operational status.

In this section we review the drivers of this and other outcomes. The outcome drivers that authors concentrate on vary but can be broadly grouped as *resources* or *forms of capital* (17 articles); *cognition and motivation* (9), and *process characteristics and behaviors* (15). Some cover more than one of these. Again, a great variety of research questions have been pursued, such that only some aspects of the research can be meaningfully aggregated or generalized.

Resources, cognition and motivation. Many analyses include human capital (HC) variables. We summarize these in Table 1. When interpreting these results it is important to note that entries across countries represent independent tests whereas entries within country columns are based on the same data set (except for the US where different data sets have been developed although most analyses refer to the original PSED).

TABLE 1

Summary of findings on outcome effects of human capital by country

Human capital indicator	*Study and effect*[a]																	
	US[b]			Canada[c]			Netherlands[d]			Norway[d]			Sweden[e]			Total		
	+	0	-	+	0	-	+	0	-	+	0	-	+	0	-	+	0	-
General human capital[f]																		
Education	4	27	0	0	1	0	0	6	0	0	1	0	1	9	0	5	44	0
Work experience	0	18	1	0	1	0	0	4	0	n/a	n/a	n/a	0	6	0	0	26	1
Team vs. Solo/Team size	0	17	0	n/a	n/a	n/a	0	7	0	n/a	n/a	n/a	3	10	3	3	34	3
(Age)	6	23	0	n/a	n/a	n/a	0	3	1	1	0	0	1	13	1	8	37	2
(Gender - female)	0	34	0	2	2	0	0	4	0	0	3	0	1	5	0	3	42	0
(Ethnicity or minority status)	0	5	2	n/a	n/a	n/a	n/a	n/a	n/a	0	1	0	n/a	n/a	n/a	0	6	2
Specific human capital																		
Management experience	1	12	3	n/a	n/a	n/a	1	3	0	n/a	n/a	n/a	1	5	0	3	22	3
Industry experience	5	11	0	0	1	0	0	4	0	n/a	n/a	n/a	4	19	0	9	35	0
Start-up experience	4	26	4	0	2	0	1	5	0	4	2	1	15	13	2	24	46	7
Business or start-up classes	1	9	0	0	2	0	n/a	n/a	n/a	n/a	n/a	n/a	2	4	0	3	15	0
Other	n/a	n/a	n/a	2	0	0	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	2	0	0

a) + denotes a sig. positive effect; 0 denotes no significant effect; - denotes a sig. negative effect ($p<.05$); b) based on Brush et al. (2008a); Dimov (2009); Edelman et al. (2008); Liao and Gartner (2006); Liao et al. (forthcoming); Lichtenstein et al. (2007); Newbert (2005); Parker (forthcoming); Parker & Belghitar (2006); Tornikoski and Newbert (2007); Townsend et al. (in press); c) based on Diochon et al. (2005a); Menzies et al. (2006); d) based on van Gelderen et al. (2005); e) based on Alsos and Kolvereid (1998); Alsos and Ljunggren (1998); Rotefoss and Kolvereid (2005); e) based on Davidsson and Honig (2003); Delmar and Shane (2003); Delmar and Shane (2004); Honig and Karlsson (2004); Eckhardt et al. (2006); Samuelsson and Davidsson (2009); Shane and Delmar (2004); f) We have reluctantly (hence the parentheses) followed the practice of including age, gender and ethnicity among the indicators of general HC.

An overall interpretation of the results suggests that HC influences on venture creation outcomes are weak or inconsistent, with reported lack of significant effects dominating the picture. In some instances this is in line with reasonable expectations, as well as with prior literature. The lack of effects of gender is very clear. The PSED-type research firmly establishes that once in the process, there is no female under performance regarding (early) outcomes. This mirrors the main conclusion from other types of research (DuRietz & Henrekson, 2000; Watson, 2002). However, the PSED-type research suggests there are gender differences regarding details in the process (Murphy et al., 2007) as well as for type of business and markets served (Menzies et al., 2006).

While there is some tendency towards positive effects of start-up experience and – to a lesser extent – industry experience and education, the fact is that the reporting of non-effects is the most common also for these variables. This is not unlike prior literature. Storey's (1994) review found no support for prior start-up experience influencing growth and only mixed support for education having a positive influence. A recent meta-analysis suggests the overall influence of HC on entrepreneurial outcomes is positive but surprisingly weak (Unger et al., 2009). While this meta-analysis suggested that that HC effects are stronger for younger firms, our overall results do not extend this conclusion to the very early stages of venture creation.

Moving beyond HC and Table 1, we find that effects of financial resource endowment variables have been surprisingly little studied and that in the few studies that report any effects of such variables the findings are unimpressive (Liao & Gartner, 2006; Parker & Belghitar, 2006; Reynolds, 2007; Rotefoss & Kolvereid, 2005). Effects of social capital (SC) are also unimpressive for the most part. For example, there is no consistent effect of presence of role models on outcomes (Davidsson & Honig, 2003; Parker & Belghitar, 2006; Honig & Karlsson,

2004; Samuelsson & Davidsson, 2009). Being a team- rather than solo start-up (an indicator of either HC or SC) has not been ascribed any consistent effect on outcomes, either (Davidsson & Honig, 2003; Chandler et al., 2005; Delmar & Shane, 2006; Edelman et al., 2008; Honig, 2001; Honig & Karlsson, 2004; Parker & Belghitar, 2006; Tornikoski & Newbert, 2007; van Gelderen, Thurik & Bosma., 2005). This is unlike studies of established small businesses where positive effects are relatively consistently reported for team size or team vs. solo firm (e.g., Chandler et al., 2005:706; Storey, 1994:130). Possibly, at very early stages of business development the increased complexity of coordinating the goals and skills of multiple people cancel out any positive performance effect.

Findings regarding the role of motivation and aspirations do not yield a very consistent aggregate picture, either (Cassar. 2007; Liao and Gartner, 2006; Townsend, Busenitz & Arthurs, in press; van Gelderen et al., 2005). Again, this is in contrast to prior literature where at least in studies using growth as the outcome variable there is compelling evidence that variables like the owner-manager's growth motivation, communicated vision and goals are positively associated with the firm's subsequent growth (e.g., Baum & Locke, 2004; Delmar & Wiklund, 2008: Storey, 1994; Wiklund & Shepherd, 2003).

Making sense of the (non-)effects. The aggregate findings regarding outcome effects of the founders' resource endowments and motivations are weak or inconsistent, and may appear disappointing. However, a closer look at the results reveals a number of meaningful patterns in the light of four insights derived from the prior literature. These four insights are the following:

1. That it may be overly simplistic to assume that effects on outcomes are direct, linear and generalizable across all types of ventures, founders, and environments. For example, in prior research on the type of outcome drivers reported in Table 2, Wiklund & Shepherd (2003) found

that education and experience have much stronger relationship to growth if growth aspirations are also high. Similar contingencies should be expected for drivers of start-up progress and success.

2. That the venture and the individual are distinct levels of analysis (cf. above). For example, Davidsson and Wiklund (2001) point out that explaining outcomes for a particular venture based on characteristics of one founder is problematic when more founders are involved or when the founder runs additional ventures. In the former case the venture draws on a larger resource pool and in the latter on a smaller one, than what is implicitly assumed when the focal individual's resource base is related to the focal venture's performance. Failure to recognize this will dilute or distort estimated relationships.

3. That the opportunity cost structure needs to be considered when assessing the effects of human capital on outcomes (Gimeno et al., 1997; Shane, 2003). This may partly explain the weak overall relationship Unger et al. (2009) found in prior research. Individuals with more human, social and financial capital are likely to have more attractive outside options. They are therefore likely to be more prone to terminate the effort at a given (marginal) level of performance. They may also start more ambitious and complex ventures that take longer to reach certain performance criteria without necessarily being less successful in the longer run. These opportunity cost effects may confound estimated relationships.

4. That outcomes for independent ventures are hard to assess, predict and interpret (Brush & Vanderwerf, 1992; Cooper, 1995; Davidsson, 2008). Arguably, this problem is aggravated when the study concerns emerging firms that develop at different pace and where traditional performance measures such as levels of sales and profitability have limited applicability. This suggests that results should be interpreted with great care and that several outcome indicators

may be needed in order to better understand the contingencies. For example, prior literature specifically dealing with human- and other capital has made the point that the drivers of marginal survival may in part be different from the drivers of high performance (Cooper, Gimeno-Gascon, & Woo, 1994; Dahlqvist, Davidsson, & Wiklund, 2000).

A closer examination of the results compiled in Table 2 strongly suggests that studies that have paid more attention to these four issues are much more likely to yield credible evidence of effects on performance. As regards the first issue, the positive results for education in Table 2 were obtained with non-linear specifications (US) or for innovative ventures only (Sweden). The positive effect of management experience in the Dutch data refers to 'high ambition' ventures only. In the same study, the positive effect of prior start-up experience appeared only in a sub-group of founders with low scores on other forms of experience, suggesting that relevant competence can be achieved through alternate routes. The Norwegian results for start-up experience suggest that parallel but not serial entrepreneurs outperform novices; that the process favored by serial founders is suboptimal (cf. Lichtenstein et al., 2007), and that those with prior unsuccessful start-up experience are over represented among NEs but not among those who get their start-up operational. This all implies that 'start-up experience' does not necessarily reflect 'venture creation competence' and that a sample of 'serial entrepreneurs' will be 'contaminated' by a sub-sample of 'serial failure creators' (cf. Diochon, Menzies & Gasse, 2007). In this light it is not surprising that many reported analyses fail to find a positive effect on outcomes.

Regarding the relationship between human capital and outcomes, Dimov's (2009) study deserves particular mention. Rather than assuming direct (deterministic) effects of industry- and start-up experience, Dimov (2009) argues that this relationship is mediated by the founder's 'opportunity confidence'. That is, he maintains that these HC variables will only drive outcomes

to the extent that the founder really believes in the project. At least for start-up experience this sensible conjecture is supported by the data.

By restricting his sample to solo start-ups only Dimov (2009) also addresses the issue of level of analysis. The positive effects of industry experience in Table 2 emerge when the analysis is limited to solo founders only (US) or when the experience was assessed across all team members rather than just the respondent (Sweden). Similarly, the positive effects of start-up experience for both Sweden and the US mostly appear in analyses where the entire teams' experience is considered. This clearly suggests many non-results are at least partly due to levels mix-ups. Taking into consideration that other individuals may be involved in the focal venture and that the focal venture may not be the sole interest of the focal individual make it clear that effects should be expected not from *the respondent's resource endowments* but from *the teams' resource investments in the venture.* Accordingly, in contrast to the many weak findings in Table 2, Brush, Edelman and Manolova (2008a) found strong effects of investments in/of organizational, physical and financial resources. Townsend et al. (in press) back this up as regards money invested. Many of the relationships reported by Reynolds (2007) can also be interpreted in the light of this distinction between endowment and investment. It is also in line with some of Unger et al's (2009) conclusions from their meta-analysis of prior research, namely that HC effects are stronger for task-related HC and when HC is assessed in a more direct manner (e.g., actual knowledge and skills vs. years and type of education).

Using opportunity costs as the basis for his theoretical argument, Cassar (2006) showed that those with more wealth and managerial experience have higher aspirations for their business' future size (cf. Liao and Gartner, 2006; Singh et al., 2008). If and when it starts to seem unlikely that these higher standards will be met, these NEs are likely to withdraw. This

would produce the zero or negative effects for capital variables that we see in Table 2. This is also arguably what causes aspirations to be unrelated or negatively related to some outcome variables. Thus, it suffices that those with higher aspirations do not achieve more than others *in relation to their own goals* for aspirations to be unrelated to (some) outcomes. Accordingly, Diochon, Menzies and Gasse (2005a) show that NEs with higher growth aspirations are more likely to terminate, while Brush et al. (2008a) found those with higher 5th year sales aspirations to be less likely to have reached first sales. The Dutch team found that those intending to invest more in the start-up had lower probability of getting operational by a given date, and that lowering the intended investment increased this probability (van Gelderen et al., 2005). It seems plausible that this reflects reorientation towards starting a simpler venture than originally conceived, and it should not be misinterpreted as evidence that lower investment is associated with greater ultimate success.

With this we have arrived at the importance of carefully interpreting the meaning of outcome variables and of using several such indicators. Before going deeper into this issue let us first describe the various types of performance indicators that researchers have been using:

1. The achieving of particular, non-financial milestones (such as completing product development or obtaining external funding) or the number of gestation activities completed between two points in time; i.e., indicators of making progress in the process.
2. Self-reported status of the venture, in terms of ‘terminated’, ‘still trying’, and ‘operational’, sometimes dichotomized into ‘continuing’ vs. ‘terminated’; ‘operational’ vs. ‘not (yet) operational’, or ‘operational’ vs. ‘terminated’.
3. Achieving financial milestones such as sales, positive cash-flow or profitability.
4. Continuous measures of levels of sales or profits.

Similar to Cooper et al.'s classic example (1994; cf. above), Delmar and Shane (2006) found differential HC effects on survival and sales. Comparing different outcome variables over time was also central to Davidsson and Honig's (2003) main conclusions that the relative importance of social capital increases over the course of the venture creation process (cf. Samuelsson & Davidsson) and that more specific forms of capital gain importance over time.

To sum up, a first glance across studies suggests that effects of resources and motivations on outcomes are weak or non-existent. However, a deeper look reveals that this is a false conclusion. Studies that consider non-linear and contingent relationships and pay attention to level of analysis issues have found these types of variables to be of importance at least for certain types of venture or with respect to certain types of outcomes.

Process characteristics and behavior. A number of articles report results on how the completion of individual gestation activities relates to outcomes. Many have addressed the debated issue of the merits of business planning, which makes it meaningful to summarize the results in a table. Research on this topic again illustrates the importance of examining effects on different outcome indicators. In Table 2 we therefore organize the reported findings on business planning by type of outcome.

Starting in the rightmost column, the overall results seem to indicate a moderately positive effect of business planning, much like what meta-analyses have concluded for established small firms (Brinckmann, Grichnik, & Kapsa, 2010; Schwenk & Shrader, 1993). The evidence also seems mildly in favor of early planning and more comprehensive forms of planning. However, a closer inspection reveals that practically all positive results concern staying in the process rather than leaving it, i.e., persistence or – at best – making progress.

TABLE 2

Summary of findings on business planning effects by planning measure and outcome

	Outcome measure and effect[a]																				
	Making Progress[b,1,2,3,4]			Continuation vs. non-continuation[c,d,1,5,6,7,8,9]			Reaching first sales[4,10]			Operational vs. terminated[c,11]			Operational vs. any other status[c,4,6,7,12]			Reaching profitability[7]			Total		
	+	0	-	+	0	+	+	0	-	+	0	-	+	0	-	+	0	-	+	0	-
Completed business plan of any form	8	6	0	3	3	0	0	4	0	2	3	1	0	3	0	0	1	0	13	20	1
Composite measure of extent of planning	2	0	0	1	1	0	n/a	n/a	n/a	n/a	n/a	n/a	0	4	0	n/a	n/a	n/a	3	5	0
Sequence measure of early planning	n/a	n/a	n/a	6	2	0	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	6	2	0

The same work may report multiple models; the table summarizes all reported multivariate findings. a) + denotes a sig. positive effect ($p<.05$) ; 0 denotes no significant effect; - denotes a sig. negative effect ($p<.05$); b) completion of particular gestation activities other than financial milestones, or accumulation of activities; c) based on self-perceived venture status in follow-up interviews; d) some analyses performed as terminated vs. all other outcomes have been reversed. 1) Delmar and Shane (2003) [SWE]; 2) Delmar and Shane (2004) [SWE]; 3) Eckhardt et al. (2006) [SWE]; 4) Tornikoski and Newbert (2007) [US]; 5) Brush et al. (2004) [US]; 6) Dimov (forthcoming) [US]; 7) Honig and Karlsson (2004) [SWE]; 8) Liao and Gartner (2006) [US]; 9) Parker & Belghitar (2006) [US]; 10) Newbert (2005) [US]; 11) van Gelderen et al. (2005) [NL]; 12) Edelman et al. (2008) [US].

Since staying in the process may equate throwing good money after bad the sound conclusion from Table 2 seems to be that there is no evidence in this stream of research for business planning leading to more (or less) successful outcomes at early stages of new venture development. Similarly, Brinckmann et al. (2010) found weaker positive effects for new firms than for the more established. They therefore conclude that "contingencies such as uncertainty, limited prior information, and an absence of business planning structures and procedures can limit the return on business planning." (p.25). This may apply even more to the pre-operational stage of venture creation.

As regards sequencing and timing of particular activities (other than business planning) no very clear patterns appear (Brush, Manolova & Edelman, 2008b; Delmar & Shane, 2004; Tornikoski & Newbert, 2007; Townsend et al., in press). Again, this may in part be due to the researchers varying use of outcome variables. Aggregating the activities into conceptual categories, Carter, Gartner and Reynolds (1996) made an early argument that NEs who terminated or reached operational status undertook more activities, and in particular more tangible, externally-oriented activities, than those who were 'still trying'. This suggests that undertaking more activities, of itself, leads to a resolution in either direction. However, more recent findings suggest that the more general pattern is that the more activities that have been undertaken, the less likely are the founders to terminate the start-up (e.g., Brush et al., 2008b; Edelman & Yli-Renko, in press; Shane & Delmar, 2004).

A promising, alternative approach to relating process characteristics to outcomes is provided by Lichtenstein et al. (2007). Disregarding the sequence of *particular* activities (or categories thereof) they show that the variability in the process can be meaningfully conceptualized in terms of the *rate* (duration between conception and outcome), *concentration*

(tendency for activities to cluster at particular times) and *timing* (average event time, normalized by duration) by which activities are completed. They hypothesize and (largely) find that higher rate, lower concentration and later timing will facilitate venture creation.

Eckhardt et al. (2006) represent another possible route to making further progress on the issue of process and outcomes, namely tighter theorizing and more sophisticated modeling in relation to one particular (in this case intermediate) process outcome. Attempting to explain which ventures receive outside funding these authors apply a multistage selection approach, first using individual-level perceptual variables to explain who seeks external funding, and then applying objective venture level variables to predict the success in obtaining funding, given that it is sought. The approach is interesting because it responds to the notion that *entrepreneurship requires human agency* (Shane, 2003). It may therefore deserve broader application.

In summary, PSED-type research on drivers of outcomes contributes new knowledge because it addresses a question that has hardly been asked in the prior literature. Rather than asking "which start-ups achieve better performance?" the research essentially addresses the question "which start-up efforts lead to an operational firm at all?" While the evidence is not yet fully conclusive there are clear indications that in some instances the answers to these two questions are different. For example, we note that unlike prior literature, the PSED-type research stream has not found links between team size and business planning on the one hand, and more successful outcomes on the other. Other findings, like the absence of female under performance, matches the main conclusions from prior research (DuRietz & Henrekson, 2000; Watson, 2002). The same can be said about the often weak effects of various indicators of human capital and other resource endowment indicators (e.g., Unger et al, 2009). However, rather than indicating the phenomena are fundamentally non-explainable this arguably reflects challenges that this

stream of research shares with entrepreneurship research in general: the heterogeneous nature of the phenomenon; cross-level effects and mix-ups; the existence of unmeasured and variable outside options, etc. An analysis of the findings across studies as well as an examination of those studies that have been relatively more successful at explaining outcomes give good guidance regarding what is required in order to achieve strong and credible results. In the next section we will discuss how future work can benefit from these insights.

Opportunities for further progress

This review has brought to our attention methodological and conceptual challenges in this type of study as well as possible solutions to some of these challenges. The pioneering work that has been undertaken thus allows us to identify possible further improvements to research of this kind. In this section we will discuss some of these opportunities. We summarize our advice in Table 3 and elaborate on it below, where we also try to point to studies that have successfully dealt with some of the challenges we discuss. In the main text we concentrate on advice to users of existing data set. In Table 3 (and in the concluding section) we also offer some brief advice to designers of new projects.

Statistically representative and/or theoretically relevant sampling. Prior research has demonstrated some of the challenges in sampling nascent entrepreneurs or early stage ventures as well as the increased sophistication that has been achieved over time in this regard (Reynolds, 2009). One important issue is the non-negligible presence of ‘dilettante dreamers’ or ‘hobbyists’ in the samples, who are not very serious in their start-up attempts (Parker & Belghitar, 2006; Reynolds, 2007; Reynolds & Curtin, 2008).

TABLE 3

Summary of advice for users of existing data sets and designers of new projects

Issue / Category	*Users of existing data sets may want to consider…*	*Designers of new data sets may in addition want to consider…*
Statistically representative and/or theoretically relevant sampling	• Excluding 'dilettante dreamers' • Ways to deal with 'modest venture' dominance • Testing for non-response and attrition biases • Correcting through weighting the cases (individual and team levels) • Correcting through weighting down or eliminating cases (already) of long duration (venture level)	• Dealing with decline of landline phone coverage • Obtaining a larger sample to allow more sub-sample analysis • Obtaining a narrower, more homogenous and/or higher-potential sample for stronger theory testing • Including additional categories (e.g., social enterprise) • Maximizing the use of techniques for obtaining high initial and continued response rates
Level of analysis issues	• Consistently applying an explicit level of analysis from sample restriction through use of explanatory, control and outcome variables • Applying the hitherto under-utilized team level • Explicitly modeling influences or effects on different levels	• Designing the entire project with (a) specific level(s) in mind • Basing the design on the realization that the venture may draw on resources from more than one individual and, conversely, that the founder(s) may invest their resources in endeavors other than the focal venture • Including more other-than-venture level outcome indicators
Dealing with process heterogeneity	• Controlling for initial stage of development • Re-organizing the data set based on venture time line • Checking that assumed outcome 'milestones' really can be regarded process outcomes (i.e., occur late) • Applying higher level of abstraction to gestation activity patterns	• Double-checking data on activities pre-dating the first interview • Further refining conceptualization and operationalization of gestation activities
Dealing with other heterogeneity issues	• Using well thought through control variables • Applying sub-sample analysis • Modeling contingent effects (e.g., moderation; mediation)	• Obtaining a larger sample to allow more sub-sample analysis (cf. above) • Obtaining a narrower, more homogenous and/or higher-potential sample for stronger theory testing (cf. above) • Including controls/moderators/mediators not available in existing data sets
Choice and interpretation of dependent variables	• Using several, carefully selected outcome indicators • Refraining from unwarranted 'success' or 'failure' labeling of outcome indicators • Distinguishing among indicators of engagement, persistence, and success, respectively • Paying attention to heterogeneity in process duration	• Including improved measures of engagement, persistence, and success (and duration) • Including more other-than-venture level outcome indicators (cf. above) • Probing further into reasons for and losses associated with termination (individual, team and venture level)

Analysts may want to consider excluding such cases based on low level of activity or having been in the process for a long time already without reaching defined milestones. A somewhat crude but workable way of circumventing this problem is to exclude the 'still trying' category and limit the analysis to contrasting those getting operational with those that terminate (see Lichtenstein et al, 2007; van Gelderen et al, 2005).

Statistical representativeness is threatened by initial non-response and subsequent attrition. In relation to this it may be worth following the examples of Delmar and Shane (2006) and Parker and Belghitar (2006) and test for any biasing influences, and/or post-weighting the data (e.g., Kim et al., 2006; Schjoedt & Shaver, 2007). For the original PSED data set weighting issues are documented in the PSED Handbook (Gartner et al., 2004b) and on the PSED website (http://www.psed.isr.umich.edu/psed/data). However, this weighting is based on an individual level logic. When regarded as a venture level study the sampling mechanism over samples ventures that have start-up processes of long duration, because such cases are eligible for inclusion over a longer period of time. Similarly, the sampling procedure over samples team start-ups because ventures with team members from more than one household have a higher sampling probability. Where judged important this can be at least approximately corrected by weighting based on within-sample information on process duration and team sizes. As regards teams the results reported by Ruef et al. (2004) further suggest that spousal (including *de facto*) teams should be analyzed as a separate category.

For many research purposes theoretical relevance is as important as statistical representativeness, or even more so. The reviewed research makes clear that random samples are numerically dominated by relatively modest nascent ventures. The founders are usually individuals or homophilous teams (Ruef et al., 2003) whose career reasons are not that different

from those of other people (Carter et al., 2003). They typically prefer creating something small and manageable rather than pursuing maximum growth (Human & Matthews, 2004) and invest limited amounts of money in their start-ups (Kim et al., 2006). A minuscule proportion has venture capital funding and at these early stages only a distinct minority has even approached a bank (Cassar, 2009; Davidsson et al., 2009).

This 'modest venture' dominance is a fundamental issue for this line of research. While their large numbers suggest that the 'modest majority' is not unimportant in the aggregate, their ubiquity does not necessarily make them the theoretically most relevant. Importantly, they may not adequately represent the phenomenon some of the theories used were designed to explain, such as the creation of 'organizations' (Gartner, 1988) or 'entrepreneurship' as conceived by Shane and Venkataraman (2000). Somewhat ironically, the theories and data used so far in PSED-type research perform comparatively poorly for explaining outcomes among this 'modest majority' relative to the explanatory power for innovative or higher-tech ventures (Newbert, 2005; Samuelsson & Davidsson, 2009). This reveals an opportunity: we clearly need theories and models that can better explain the successful establishing of the vast numbers of largely imitative, subsistence-orientated businesses. Possibly this requires developing a better understanding of how the venture start-up is positioned in the individuals' totality of activities, needs, wants, etc. While new data collections may be needed in order to do this to full satisfaction, existing data may have more to offer than what has been effectively utilized so far. At least, users of current data set can make sure they avoid the major theory-data mismatches that occur when the analyst theorizes with high-powered, growth-orientated and innovative ventures destined for IPOs in mind, and then tests the theory on a PSED-type sample representative of the total population of emerging firms. In addition, a hitherto little used

opportunity with extant data sets would be to pool data on 'high end' cases from several national data sets.

Level of analysis issues. In our long sub-section on defining the sample we have already dealt with a number of issues related to analysis level. The fundamental advice here is to apply a consistent level of analysis all the way from theory selection through operationalization of explanatory variables and choice of dependent variables. At least as regards the first two of these steps, Dimov (2009) can serve as an exemplar regarding the individual level whereas parts of the Delmar-Shane series of papers (Delmar & Shane, 2003; 2004; Shane & Delmar, 2004) take a very clear venture level view of the data. In further restricting the sample and through their choice of explanatory variables these authors demonstrate an understanding of the methods consequences of their choices as well as of the data at hand. Eckhardt et al. (2006) provide an interesting example of explicit modeling of influences on different levels. New users of extant data can seek inspiration from these exemplars regarding how to deal successfully with levels issues despite remaining limitations of the data. They are also well advised to draw on experiences from other fields with a longer tradition of cross-level problems and effects (Kozlowski & Klein, 2000; Rousseau, 1985).

This is also a suitable place to remind about our observation that effects on venture outcomes should be expected from *specific resource investments in the venture* rather than from the resource endowments of its founders. Existing data sets provide some albeit varying opportunities in this regards. Further, we observed a very small number of articles focusing on team level issues. Especially the publicly available PSED II data set provides very rich team data. This provides interesting opportunities for future contributions. However, we would urge takers of that opportunity to keep in mind Ruef et al.'s (2004) findings about the true nature of

typical venture teams. Discussing sampling above we also noted that researchers may have reason to consider level-specific corrections for sampling biases.

Dealing with process heterogeneity. An ideal study of venture emergence would follow in real time from their conception a cohort of emerging ventures initiated on the exact same day. This is not practically possible. With the PSED approach some cases will barely meet the minimum criteria for inclusion when first contacted while others will be near established businesses and thus almost 'over qualified' for inclusion in the sample. At minimum, users of PSED-type data need to control for this, which is usually but not always the case in articles published so far. Experiences to date suggest that 'age' or 'stage' is more effectively controlled for using *number of gestation activities already completed* (e.g., Dimov, 2009) rather than *time since inception* (e.g., Samuelsson & Davidsson, 2009). Not only is the latter difficult to define unambiguously (cf. Lichtenstein et al, 2007; Reynolds, 2007); it also appears that the mere passing of time has little relationship to outcomes whereas number of completed activities is a control variable of major importance (Davidsson et al., 2009). This said, a particularly sophisticated way of dealing with this problem is to use the time-stamped gestation activity information to re-organize the data set according to fully aligned 'project time' rather than to waves of interviewing in calendar time, as the latter is arbitrary in relation to the venture's own time scale (see Delmar & Shane, 2003; 2004; Reynolds, 2007). This is a recommendable solution as long as it does not counteract other purposes of the analysis. Another sophisticated approach that lends itself to some research questions is to employ an analysis technique capable of modeling both initial state and progress over time (Samuelsson & Davidsson, 2009).

Apart from differential initial state, sequence and duration heterogeneity in the process provide additional method challenges as well as an interesting research questions. Among the

method challenges are that achievement of financial outcomes conceived of as process outcomes, such as first sales and positive cash-flow, can occur quite early and before much organizational structure or routines have been developed. Therefore, users of this type of data are well advised to carefully consider the timing of their intended dependent variables. As a research question, it has turned out quite a challenge to find any meaningful pattern or predictive ability in the sequencing of particular activities (Liao et al., 2005), although the hunt continues (Liao & Ye, 2009). More abstracted approaches which group activities into conceptual categories are likely to be somewhat more successful (e.g., Brush et al., 2008b; Delmar & Shane, 2004). However, Lichtenstein et al.'s (2007) approach to disregard specific activities and instead concentrate on the temporal pattern of (any) activities appears even more promising.

Using several different outcome measures can also mitigate the problem of process heterogeneity as it makes it easier to disentangle duration issues from success issues. We will expand the discussion of outcome assessment further below.

Dealing with other heterogeneity issues. A random sample of NEs or emerging ventures will be heterogeneous along many dimensions, including aspects other than those highlighted by a particular analysts theoretical input. For example we found that among the many non-effects for capital variables there were several instances were outcome effects in a meaningful way appeared for certain sub-groups or contexts. At a minimum this calls for including control variables, which most authors of the reviewed works have done although some (e.g., Delmar & Shane, 2006) do it in a more thought through manner than others. However, control variables are of limited help when effects vary among sub-groups for a whole range of variables (Samuelsson & Davidsson, 2009). This points to separate sub-group analysis, the potential and limitation of which we discussed in the sampling sub-section above. It is impossible to break down the

analysis by every important contingency and still retain sufficient statistical power. In full sample analysis some analysts have successfully modeled causal heterogeneity as moderation (e.g., Liao & Gartner, forthcoming), mediation (e.g., Dimov, 2009), or via multi-stage modeling (Eckhardt & Shane, 2006). Those who have skillfully done so are also often those who arrive at stronger and more interesting results and their analysis strategies thus seem worth following.

Choice and interpretation of dependent variables. Credible assessment and interpretation of outcomes is arguably the single biggest challenge for this type of research, and an area where even some of the best examples among prior works have evident shortcomings. We have highlighted these challenges and some solutions above in the latter parts of the results section and also found reason to revisit the issue in previous parts of the current section. We will not repeat all of this here. However, it deserves re-emphasizing that our review gives reason to strongly advice against the use of a single outcome measure. Given the presence of 'dilettante dreamers' in the sample (cf. above); the process heterogeneity issues discussed above, and the pattern of results for effects of business planning in Table 2, the use of continuation vs. non-continuation as proxy for 'success' vs. 'failure' appears particularly dubious.

As a general rule we would recommend that analysts use multiple outcome measures of different kinds at least as preparatory work for their own understanding, but preferably also in their reporting in articles prepared for journal publication. In addition to those already mentioned, Dimov (2009), Honig and Karlsson (2004) and Lichtenstein et al. (2007) are some examples of thoughtful and fruitful use of multiple outcome indicators. Further, it has been pointed out that the traditional entrepreneurship research approach of comparing 'entrepreneurs' with 'non-entrepreneurs' confounds characteristics that make individuals or teams *engage, persist,* and *succeed* in independent venturing activities, respectively (Davidsson, 2004: 70). We

would encourage users of PSED-type data to think of the dependent variables in these terms, and note that existing data provide an excellent opportunity to disentangle what antecedents drive each of these three phenomena. While some works partly address this issue (e.g., Davidsson & Honig, 2003; Diochon et al., 2005a; Rotefoss & Kolvereid, 2005) there is as yet no attempt at a systematic and theory-driven analysis of these distinctions, which would constitute a valuable contribution (if 'engagement' is replaced by 'initiation' the same triplet of dependent variables can be applied to venture level analysis as well). Currently available indicators of 'success' may not be perfect but the situation is improving. For example, PSED II uses a researcher-controlled definition of being operational (proxy for 'success') where PSED had a self-report measure (Reynolds & Curtin, 2008: 224). In addition, there is the hitherto little used opportunity to use data from consecutive waves to distinguish between cases that get operational and then quickly fail from those that prove sustainable (Diochon et al., 2007; Trevelyan, 2009).

Apart from engagement, persistence and success, analysts need to consider the issue of process *duration*. Arguably, a major peril in working with this type of data is to mistake longer duration for lack of success. It may well be that ventures that take longer to reach operational status eventually show better survival, higher sales and superior profitability. We touched upon remedies in our above discussion of how to deal with heterogeneity. Davidsson et al. (2009) and Lichtenstein et al. (2007) provide further treatment of duration as a 'control' outcome.

Conclusion

The reviewed line of research has introduced a research innovation that has made it practically possible to identify large samples of business start-up efforts at an early stage and study their development over time. That is, it has introduced a less bias-prone approach to studying a very core issue in entrepreneurship: the processes by which new businesses come into

existence. The research stream has unveiled enormous diversity and complexity of such processes, thus contributing important, fundamental insights into this phenomenon. At the same time, this very complexity and diversity have made it hard for researchers to arrive at indisputable and broadly generalizable conclusions about specific cause-effect relationships within such processes. We have discussed above how some of these challenges have been or could be dealt with by users of existing data sets. We also identified some major, unused research opportunities based on these data sets, such as further investigation of team level issues; pooling national data sets in order to create more homogenous sub-groups of analyzable size, and performing theory-driven analyses of the different drivers behind engagement, persistence and success in venture creation processes.

We would argue that key elements of the basic PSED-approach – the capturing of samples of start-up efforts at a very early stage, and longitudinal follow-up of their development via repeated recording of time-stamped gestation activities – are essentially sound and should be retained in future research. This could entail further studies of representative, national samples of the 'entire' population of on-going business start-up efforts and with annual follow-ups, applying some of the refinements we have suggested above. In addition, future research could apply the 'early capture and time-stamped follow-up' idea more freely in smaller and less costly projects focusing on internally more homogeneous samples of start-ups, and using the abundance of communication means that are now available for more varied and frequent collection of longitudinal data (Couper, 2005; Uy, Foo, & Aguinis, 2009). While less broadly genaralizable such studies may be easier to organize and finance; provide suitable data for tests of specific theories and provide even richer process data than have the PSED-type projects conducted so far.

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